NOTES FROM PACIFIC COAST OBSERVATORIES.

The Zeeman Effect in the Sun.

In a previous note[1] I described my first observations of the Zeeman effect in sun-spots. Since that time many new results have been obtained.[2] It has been found that when the Nicol is set at such an angle as to transmit the violet component of a doublet in the spectrum of a spot surrounded by a right-handed vortex, it will transmit the red component in the spectrum of a spot surrounded by a left-handed vortex. In the laboratory the same effect is produced by reversing the current in the magnet, when observing the doublets along the lines of force. Hence the direction of revolution of the electrified particles in the vortex appears to determine the polarity of the resulting magnetic field, as theory requires. The observed polarity indicates that the sun-spot field is produced by the motion of negative corpuscles.

The above results are obtained when the spots are near the center of the Sun. As they advance toward the limb it might be expected that the doublets would change to triplets, as is usually the case with doublets observed in the magnetic field. As this does not occur, it is of interest to note that all of the spot doublets hitherto observed in the laboratory, with one exception, have been found by Dr. King to appear as doublets not only when observed parallel to the lines of force, but also at right angles to the lines of force. As a matter of fact, a polariscopic study of these lines, made by Dr. King, shows that they are in reality quadruplets, though the components of each of the lines of the apparent doublets are so close together that they cannot be separated in the sun-spot spectrum. The

[1] *Publications A. S. P.*, **20**, 220, 1908.
[2] *Astrophysical Journal*, November, 1908.

line λ 6302.71, when observed at right angles to the lines of force in the laboratory, is a triplet.[1] In the spot spectrum it also appears as a triplet. Since many other lines also appear as triplets in the spot spectrum, it is evident that the light of the spot is partly longitudinal and partly transverse.

A comparison of the separations of spot doublets with those of the same doublets observed in the laboratory gives, in the case of four iron lines, a remarkably close agreement for the relative separations. In the case of titanium, and other elements extending through a considerable range of level in the Sun, there are greater divergences, probably due to the rapid change in the strength of the field in passing upward through the spot. The *D* and *b* lines in the spot spectrum, which represent comparatively high levels, show but little effect of a magnetic field. Hence at the distance of the Earth the spot-field would be quite inappreciable, even with very delicate instruments. The strength of the field in spots, at the level represented by the iron doublets, is about 2900 gausses.[2]

It seems possible that the Sun itself, on account of its axial rotation, may also have a magnetic field. The polar rays of the corona, which resemble the lines of force in a magnetic field, long ago suggested this idea to several astronomers. I have accordingly photographed the spectrum of points near the Sun's pole through a Nicol (used with a rhomb) set at various angles. Some of the lines which are double or triple in the spot spectrum appear to undergo slight displacements, with reference to telluric lines, when the Nicol is rotated. I am now endeavoring to determine whether these shifts can be of instrumental origin. If not, they may be produced by the Sun's field.

GEORGE E. HALE.

MT. WILSON SOLAR OBSERVATORY, December, 1908.

"DOUBLE-STAR ASTRONOMY."

In No. 120 of these *Publications* I called attention to a series of papers with the title "Double-Star Astronomy," that were appearing in the *Observatory*. Mr. LEWIS has now

[1] This was at first supposed to be an asymmetrical triplet, but later and better photographs show it to be symmetrical, both in spot and laboratory.

[2] Since the above was written I have obtained photographs of the spectrum of a large spot showing a much stronger field.